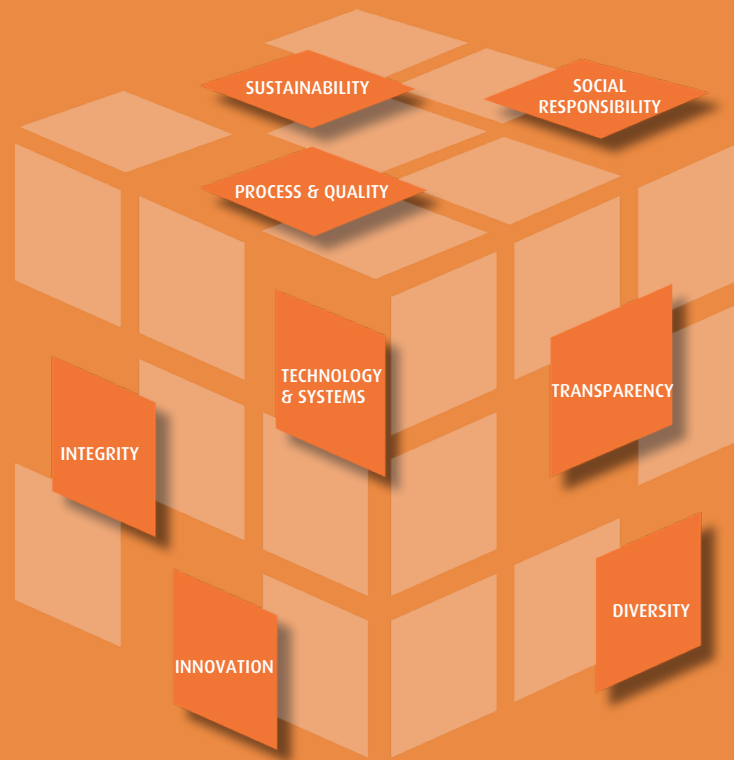


/ Spray Painting and Coating





1. Why Take Spray Painting and Coating Training?
2. Methods of Application
3. Approved Locations
4. Spray Areas
5. Spray Booths
6. Spray Rooms
7. Housekeeping
8. Fire Prevention
9. Handling Flammable and Combustible Liquids
10. Equipment
11. Maintenance
12. Health Hazards
13. Summary

Spray painting and coating safety is important!

- Spray painting and coating are widely performed in a variety of industries.
- Many hazards are associated with spray finishing.
- These may include health hazards and fire or explosion hazards.
- This presentation is to help you become knowledgeable about many of the hazards and the precautions which should be taken to avoid injury and illness resulting from spray painting and coating.

- Many different spraying methods are used to apply paints and coatings.
- The most common methods are:
 - ▶ Compressed air
 - ▶ Airless (high pressure)
 - ▶ Electrostatic



Compressed air application:

- Sometimes called conventional spray painting, this method uses compressed air to force the paint through a nozzle into a fine spray.
- This method usually requires more solvent than other methods, making a significant fire hazard.



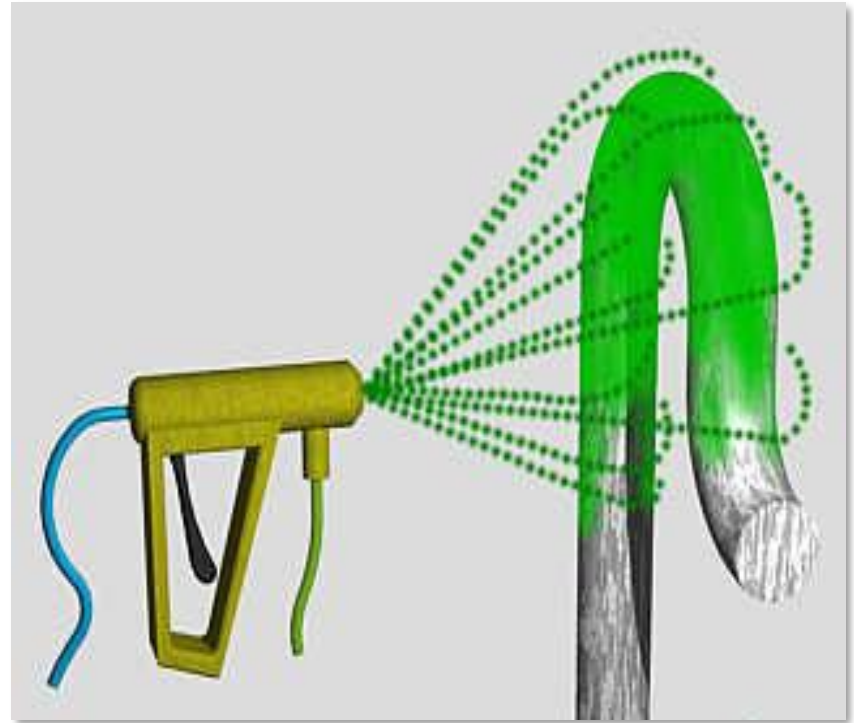
Airless application:

- Paint is forced through a small opening under very high pressure causing a spray.
- Smaller amounts of solvent are used.
- The high pressure creates a hazard of injecting paint through the skin.



Electrostatic application:

- Paint particles are negatively charged when passing through a paint gun.
- The paint is attracted to the object being painted which is positively charged and grounded.
- Sparking hazards are of particular concern.



- There are three locations which provide safe conditions for spraying flammable and combustible paints and coatings:
 1. Spray areas
 2. Spray booths
 3. Spray rooms
- The concern is with fire and explosion, as well as controlling airborne exposure to paint ingredients.

National standards:

- The National Fire Protection Association (NFPA) has established standards for the design and construction of spray booths/rooms as well as set provisions for spray areas.
- OSHA has adopted NFPA Standards.

Ventilation:

- Adequate ventilation is necessary to control fire, explosion, and health hazards when spraying.
- Health hazards may occur from exposure to excessive amounts of paint chemicals.



Spray areas:

- A spray area is any area where flammable and combustible materials are sprayed.
- Usually this refers to a designated area outside of a spray booth or room.
- Spray painting indoors but outside of a booth or room is not considered acceptable.
- A booth or room is required for production spray finishing



Design and construction:

- Ignition sources: Designated spray areas need to be located where there is no risk of vapors igniting.
- Examples of ignition sources include:
 - ▶ Non-explosion proof electrical equipment (lighting and outlets)
 - ▶ Welding or open flames
 - ▶ Grinding (sparks)
- Only special explosion proof wiring and fixtures approved for hazardous locations are considered safe where flammable and combustible gases are present.
 - ▶ This type of electrical equipment will not ignite vapor-air mixtures.

Design and construction (continued):

- Hot surfaces
 - ▶ It is important that hot surfaces are not located in spraying areas where deposits of combustible residues accumulate.
 - ▶ An example of a hot surface is a steam pipe.
- Minimum distance
 - ▶ Ignition sources must be controlled within 20 feet of a spray location.
- Sprinklers
 - ▶ Sprinklers or other automatic extinguishing equipment are necessary for spray operations, as well as ducting systems.



Spray booths:

- A spray booth is an enclosure with an open face which is mechanically ventilated.
- A booth may use baffles, dry filters, or a water washing (waterfall) system to remove paint overspray before it enters the exhaust duct.



Design and construction:

- There are numerous design and construction requirements for spray booths.
- Requirements have been established for the purpose of fire and staff protection.
- Construction:
 - ▶ Booths must be constructed of fireproof material:
 - 18 gauge steel
 - Concrete
 - Masonry
 - ▶ The exhaust duct must also be constructed of non-combustible materials.
 - ▶ Combustible floor surfaces are allowed (but not advised) so long as they are covered with non-combustible material such as steel plates.

Proper ventilation for spray booths:

- Spray booths with dry filters need to have a flow rate across the open face of the booth of 100 feet per minute (fpm).
 - ▶ For electrostatic spray operations a minimum of 60 fpm is required.
- Air intake openings to spray rooms or rooms containing booths need to be adequate to allow sufficient exhaust ventilation.



Proper ventilation for spray booths (continued):

- Make-up air: Air exhausted from spraying operations can not be re-circulated.
 - ▶ Make-up air needs to be supplied in the same direction as it is being exhausted, and should not be greater than twice the air exhaust velocity.
- Gauge or alarm: For conventional dry filter type booths or rooms, an audible alarm, visible gauge, or similar device must be installed.
 - ▶ This is to indicate that the filters are not clogged up and that there is adequate air velocity.
- When baffles or a water-wash system is used, air flow velocities at the booth opening must meet the requirements of the table on the following slide.

Operating conditions for objects completely inside <u>booth</u>	Crossdraft <u>fpm</u>	<u>Design</u>
Electrostatic and automatic airless operation contained in booth without operator	Negligible	50 large booth (range 50-75) 100 small booth (range 75-125)
Air-operated guns, manual or automatic	Up to 50	100 large booth (range 75-125) 150 small booth (range 125-175)
Air-operated guns, manual or automatic	Up to 100	150 large booth (range 125-175) 200 small booth (range 150-250)

Spray rooms:

- A spray room is a fully enclosed room with mechanical exhaust.
- It is usually used for the spray painting of large objects such as automobiles.



Design and construction:

- In general, the design and construction requirements for spray rooms is the same as for spray booths:
 - ▶ Rooms must be constructed of substantial non-combustible material having a fire resistive classification.
 - ▶ Other booth requirements mentioned need to be followed, e.g., electrical, grounding, lighting, sprinklers, etc.

Proper ventilation for spray rooms:

- Ventilation in spray rooms must be adequate to allow a minimum of 30 air changes per hour.



An excellent housekeeping program is important:

- Residue build-up can increase fire risks.
- There is the possibility of spontaneous combustion, especially if residues of different types of coatings build-up on top of each other.
- It is necessary to keep deposits of paint and coating residues from accumulating in spray areas, booths, and rooms with regular cleaning.
- If different combinations of coatings are used which may react and contribute to spontaneous combustion, then cleaning must be conducted between coats.



- Interiors of spray booths and rooms must be cleaned (non-sparking tools must be used for this purpose):
 - ▶ Exhaust ducts
 - ▶ Exhaust fan blades
 - ▶ Sprinkler system heads

Residues and wastes:

- Residue scrapings, used rags, waste paper, and other debris which may contain flammable or combustible liquids and paint residue need to be removed and placed in specific containers.
- Containers must be made of metal, have self-closing metal and sealed lids, and be properly labeled.
- They must be emptied at least once a day.





NO SMOKING

Meeting construction requirements alone will not eliminate potential fire hazards from spray painting.

Regular maintenance at spray painting operations is important in preventing fire.

Smoking:

- Smoking is not permitted in areas where flammable and combustible liquids are kept and at spraying operations.
- “NO SMOKING” signs need to be posted at all spraying areas and paint and solvent storage areas.

Other ignition sources:

- No open flame or spark producing equipment are allowed at spraying operations.
- Hot surfaces are not allowed where combustible residues may accumulate (an example of this is a space heater).

Sprinklers:

- If a fire breaks out in a booth, chances are that the fire will be controlled if the booth has sprinklers.
- Sprinklers must be installed both upstream and downstream from the filters.
- The exhaust duct also needs to have sprinklers.



Bonding and grounding:

- When flammable liquids are transferred from one container to another, this can result in static sparks igniting vapors.
- To prevent this, an electrical connection or bonding wire must connect the two (metal) containers.
- The two containers can also be connected to electrical grounds to prevent sparks.
- Dispensing containers such as drums always need to be grounded.



Bonding and grounding (continued):

- Containers more than one quart need to be grounded and bonded.
- Piping systems for flammable liquids need to be permanently grounded.
- Be sure that grounding systems are continuous to earth.



Certain safe work practices need to be followed to address fire hazards when handling flammable and combustible solvents.

Storage:

- The quantity of flammable and combustible liquids kept in the vicinity of a spray operation needs to be kept to a minimum (this normally refers to the amount used in one day or work shift).
- Storage of large quantities of flammable and combustible liquids at a spray operation would increase the intensity of the fire if one broke out, possibly causing the fire to spread and cause more damage.
- No more than 120 gallons of flammable and combustible liquids (660 gallons in portable tanks) can be stored in an area of a building except in an approved storage room.

Storage (continued):

- For extremely flammable liquids with a boiling point below 100o F e.g., Ethyl Ether, only 25 gallons in containers can be stored in a location outside of an approved storage room.
- An approved storage room must have special fire-resistant construction, explosion-proof wiring and lighting and meet other requirements.



Approved containers:

- Only certain containers or piping systems should be used to bring flammable or combustible liquids into a spray room or booth.
- Original closed containers or approved safety cans are considered acceptable (piping systems are also sometimes used).



Transferring liquids:

- The transfer of flammable or combustible liquids in a building must be through a closed piping system, from safety cans, with a device drawing liquid through the top of a container, e.g., a pump, or with a self-closing valve.
- For containers over 60 gallons, only approved pumps are allowed.

Electrical equipment:

- Electrical equipment in spray booths and areas immediately adjacent to booth openings must be approved explosion-proof types.
- This includes such incidental equipment as electrical space heaters, portable sanders, and radios.
- For electrostatic spraying, most electrical equipment such as transformers, power packs, and control apparatus need to be located outside the booth.
- The electrostatic gun itself can be located in the booth.



Exhaust fan:

- To prevent ignition of vapors, electric motors driving exhaust fans must be outside booths or ducts.
- The fan belt must also be placed outside of the duct unless the belt is enclosed.
- The fan rotating element needs to be non-sparking.

Deflector:

- A 2 1/2 inch deflector or curtain is needed at the upper edge for booths with front openings greater than 9 square feet.



Grounding maintenance:

- All metal parts of a spray booth including pipes and ducts need to be grounded.
 - ▶ If an airless system is used, then the spray gun and metal objects must also be grounded.
- Electrostatic spraying requires special care.
 - ▶ The gun, the object being painted, and all conductive equipment need to be grounded.
- Hooks holding objects need to be cleaned to bare metal to ensure grounding.
- When a hand-held gun is used, the gun must be held twice the sparking distance or at least 12 inches from the piece and all other conductive equipment.

Interior surfaces:

- Interior surfaces need to be smooth to prevent pockets of paint and coating residues.





Lighting:

- Regular fixed lighting can be used to light a booth so long as the lights are separated from the booth by non-combustible panels.
- An example of a non-combustible transparent panel is sealed glass which is protected against breakage.
- Portable lamps are not permitted.
- Explosion-proof lights are acceptable.

Health hazards:

- Many types of painting and coating materials with different potential health effects are applied in industry including solvents, Hexavalent chromium, lead, and other toxic chemicals.
- It is not possible to describe fully in this presentation the health hazards from all the spray finishing materials. Refer to the Hazard Communication Plan and applicable Safety Data Sheets.
- Therefore this section will concentrate on health hazards of some of the most common hazardous materials.
- A thorough hazard assessment of all materials and establishment of proper controls before materials are handled is necessary.



Organic solvents:

- Beside being fire hazards, organic solvents are known to affect the central nervous system, liver and blood forming tissue.
- Solvents act as depressants and anesthetics on the system.
- Due to the large number and types of solvents, specific effects vary widely depending on the actual solvent.
 - ▶ Some solvents are irritants to mucous membranes, some affect the liver and kidneys, and others affect the blood system.
- Review the Safety Data Sheets and follow controls listed!

Organic solvents (continued):

- Solvents dissolve the natural fats and oils in the skin.
- Excessive skin contact will cause dermatitis, and inflammation of the skin.
- Solvents should not be used to clean the hands or other body parts.



Isocyanates:

- Isocyanates are hardeners found in polyurethane paints and some lacquers.
- Sometimes they are added separately to paints.
- Inhalation of isocyanates may cause an asthma-like attack characterized by difficulty in breathing and a constricted feeling.
- Some people develop sensitization, so that asthma symptoms appear even at extremely low concentrations.
- Irritation to the skin and eyes can also result from contact with isocyanates.
- When respirators are used as protection against overexposure to isocyanates, only supplied air types are allowed.
- Use of air purifying respirators is not acceptable due to poor warning properties (odor).

Epoxies:

- Epoxies are mild to strong skin irritants and some are allergic skin sensitizers.
- This does not apply to fully cured epoxies but applies to the uncured resins and curing agents.
- Some curing agents, particularly certain amines may cause burns and eye damage upon contact.



Lead:

- Although becoming less common, lead is still found in some paints (other hazardous metal ingredients may exist as well, such as, chromium, copper, etc. in paints).
- When inhaled, lead is absorbed through the lungs and upper respiratory tract.
- If such things as food or cigarettes are handled with lead contaminated hands, the lead may result in ingestion.
- Chronic overexposure to lead may result in severe damage to the nervous, kidney, reproductive, and blood forming systems of the body.



Chromium (chromates):

- Exposure to certain chromates used in paint pigments poses a cancer risk.
- Other toxic metals found in certain paints include antimony, copper, cadmium, strontium, and mercury, etc.
- Review the Safety Data Sheets (SDSs) and specific OSHA standards before handling and establish proper controls and monitoring evaluations.



Deflocculants:

- Deflocculants are sometimes used in water wash booth systems to minimize foaming.
- They can be corrosive and present an eye and skin hazard.
- Suitable eye and skin protection needs to be specified, such as chemical goggles, and should be worn if there is a chance of splashing.
- An eyewash/safety shower is needed in the vicinity.



- Be knowledgeable of the health and fire risks.
- Establish proper handling controls and hazard communication training before handling materials through your hazard assessment process.
- Identify loss sources and needed controls.
- Train and ensure all workers exposed are aware of the hazards and needed controls.
- Observe and communicate.
- Analyze continual improvement.

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For more information, please contact:

safety.us@atalianworld.com

ATALIAN Global Services
417 Fifth Avenue, New York, NY 10016
www.atalian.us

